

Technical News Bulletin

of the

National Bureau of Standards

* Issued Monthly *

Washington

January 1945¹

Number 333

CONTENTS

	Page		Page
London screw thread conference.....	1	Thermal spalling of fire-clay brick.....	4
Measuring the coefficient of restitution and the spin of a ball.....	2	Corrosion of underground pipe lines.....	5
Frequency meter for Geiger-Müller counter.....	2	Willing-to-certify sources of supply of petroleum products.....	5
Freezing points of nickel and cobalt.....	2	New Mathematical Tables.....	5
Evaluation of surface finish on metal.....	2	William Weber Coblentz retires.....	6
Case-lining papers.....	3	New and revised publications issued during December 1944.....	7
Wearing quality of sole leather.....	3	Mimeographed material: Letter Circulars.....	7
Hydraulic brake failures.....	3	Recent articles by members of the Bureau's staff published in outside journals.....	7
Effect of type of bar on width of cracks in reinforced concrete.....	4		

LONDON SCREW THREAD CONFERENCE

On November 10, a meeting was held in the Social Security Building, under the chairmanship of W. L. Batt of the War Production Board, for the purpose of reporting to Federal agencies in Washington the results of the United States-Canadian Screw Thread Mission to London, and of discussing plans for continuing the work. The meeting was attended by representatives of the Departments of State, War, Navy, and Commerce, and of other interested groups. The representative of the Department of Commerce was Henry W. Bearce, chief of the Weights and Measures Division of the Bureau, who had been the Department's delegate to the London Conference. The results of the conference were reported by E. J. Bryant, chairman of the Mission, and copies of a printed report of the meeting were distributed. Speakers for each of the groups represented at the meeting expressed satisfaction with the progress so far made toward the adoption of a unified system of screw thread standards in the United States, Canada, and

Great Britain and the hope that the work may be continued and the final objective attained.

A similar meeting was held in the Engineering Societies Auditorium in New York on November 16, at which a full report on the London Conference was given to the engineering societies and the public. The meeting was attended by several hundred persons, and the report was well received. At an afternoon session on the same day reports were made by the individual members of the Mission, each member discussing in detail the special subjects for which he had been responsible at the Conference. Many pertinent questions were asked by members of the audience, and there was a full afternoon of interested discussion.

At a meeting on November 17, under the auspices of the Screw Thread Committee of the American Standards Association, preliminary steps were taken toward an extensive research program on screw threads. This project was planned, in general terms, during the London Conference as an essential move in bringing about a unification of screw thread standards in the United States, Canada, and the United Kingdom.

¹ Published with approval of the Director of the Budget.
624165-45

MEASURING THE COEFFICIENT OF RESTITUTION AND THE SPIN OF A BALL

In the Journal of Research for January, Lyman J. Briggs, Director of the Bureau, discusses four methods for measuring the coefficient of restitution of a partially elastic ball when struck, and its spin when the ball rebounds from a smooth, inclined plate after striking it at a known angle.

The experiments on which this paper (RP 1624) is based, where made by Dr. Briggs several years ago when he was chief of the Mechanics and Sound Division. Golf balls and baseballs of prewar quality were used in the work, and four methods of determining the coefficient were tried.

The first method was originally developed by Prof. H. A. Thomas of the Carnegie Institute of Technology and employs two ballistic pendulums. The ball is placed on a rubber tee a short distance in front of the muzzle of a horizontal air gun that fires a flat-nosed wooden projectile. When the ball is struck it passes through the first pendulum and is caught in the second, whereas the projectile, being of larger diameter than the ball, is caught in the first pendulum. The deflections of the two pendulums, from which the velocities of the ball and projectile can be calculated, are shown by recording pointers (Technical News Bulletin No. 252, April 1938).

A method based on spark photography was next used. The procedure is similar to that adopted in photographing projectiles in flight, and yields interesting shadow pictures from which the ratio of the speed of the ball to that of the projectile can be determined.

As a third method, the vertical rebound of a ball when dropped from a known height onto a massive horizontal plate is measured, correction being made for air resistance.

The fourth and last method is based on the measurement of the angle of reflection of a ball rebounding from a smooth, inclined plate, the angle of incidence being known. In using this method, a correction for spin must be applied because the plate, of necessity, is not ideally smooth. The various ways in which the spin velocity can be measured are outlined, and an approximate method is given for computing the spin when the coefficient of restitution is known.

The variation of the coefficient of restitution of golf balls with impact speed and with temperature was determined experimentally, and a method for finding

how long the ball remains in contact with the club is described. The coefficient of restitution (which is approximately 0 for a plastic material like putty and nearly 1 for a highly elastic material such as steel) is, for a golf ball when hit hard, roughly 0.7 and for a baseball, 0.45.

FREQUENCY METER FOR GEIGER-MÜLLER COUNTER

In the Journal of Research for January (RP1627), L. F. Curtiss and B. W. Brown describe an improved circuit for reading the rate of pulses from a Geiger-Müller counter. Based on the usual procedure of leveling and rectifying the pulses to charge a condenser, the improvements concern a bridge type vacuum-tube voltmeter to read the voltage on the condenser and an arrangement to compensate parasitic potentials developed in the rectifier for the pulses. Since only one small transformer provides an adequate source of potentials, the circuit is particularly useful in portable instruments. Great care has been taken to design a circuit that is independent of the voltage of the alternating current mains from which it is operated. A modification of the circuit for rapidly decaying sources is also described.

FREEZING POINTS OF NICKEL AND COBALT

Freezing points of metals serve as accurate reference points in the measurement of high temperatures. Very accurate measurements are required to establish these points, which now include silver, gold, platinum, rhodium, and iridium. The freezing points of nickel and cobalt have just been added to the list of such reference points. Calculated on the International Temperature Scale these freezing points are nickel, 1,455°C and cobalt, 1,495°C.

EVALUATION OF SURFACE FINISH ON METAL

During recent years great progress has been made in the art of mechanically finishing metal surfaces as regards both quality and control of the finish. However, no method of specifying a finish with particularity has heretofore been developed sufficiently to be universally acceptable to industry. An important element in such specifications is the evaluation of the depth of surface markings or serrations. Although several devices now used for making this

measurement have proved useful, they nevertheless have certain limitations. A method of qualitatively evaluating a surface finish, developed by Harry K. Herschman of the Bureau's Metallurgy Division, appears promising in connection with the preparation of specifications and the establishment of standards.

The method, described in the January Journal of Research (RP 1625), is based on the use of a nearly transparent plastic replica of the surface. The accuracy of reproduction of minute surface characteristics in such a film is attested by the fact that similar replicas are used in the study of metal microstructures at high magnifications with the electron microscope. In the present case, the film is formed by applying a suitable solvent to the metal surface, after which a strip of preformed plastic film is pressed on. The solvent softens the side of the film adjacent to the surface being examined and thus permits it to flow and conform under pressure to the surface irregularities. The replica thus formed dries in about 1 minute and then is stripped readily from the surface.

In evaluating the finish, a narrow beam of light is passed transversely through the moving replica, and thence onto a photoelectric cell. Variations in the geometric characteristics of the replica that correspond to the serrations in the metal surface control the intensity of the light transmitted through the film and reaching the photo-cell at any instant. The variation in light intensities produces a fluctuating voltage in the photo-cell circuit, which can be measured with an electronic voltmeter. The voltage readings increase with increased roughness of surface finish. The voltage readings can be translated into "roughness" evaluations by calibrating the voltmeter in terms of profile measurements of the surfaces, determined by microscopical means.

CASE-LINING PAPERS

At the request of the War Production Board, the Bureau is participating in an investigation of asphalted waterproofed papers for lining shipping cases. The object of the investigation is to develop improved specifications that will insure satisfactory performance of the papers in overseas shipments of supplies to the armed forces. Both the finished papers and the sheets from which they are made are being subjected to all tests considered to have a possible bearing on serviceability. It was neces-

sary to develop new or improved apparatus for some of these tests.

Packages containing the same papers, used as case liners, are being subjected to simulated service conditions at a commercial testing laboratory. The packages are put through cycles of being tumbled in a drum, dropped on a concrete floor, and bounced up and down on a vibrator, with wetting, under both tropical and arctic conditions. They are then examined for permeation of moisture and for the condition of the liners. It is expected that comparison of the performance of the papers in the package tests with the results of the laboratory tests will enable the Government to specify and procure papers for packaging that will insure delivery of military supplies in good condition at any destination.

WEARING QUALITY OF SOLE LEATHER

Recent service tests of 20 commercial tannages of vegetable sole leather have shown that the differences in their wearing qualities are quite small. The difference between the best and the worst of the tannages was less than 16 percent, and 15 of the tannages were within 5 percent of the average. The tests also showed that additional compression of the soles, similar to that produced by heavy rolling, resulted in an improvement of 5 percent in the wear. The soles were tested on 500 pairs of shoes worn by a regiment of Officer Candidates at Camp Lee, Va., and by workers in war industries, all tests being under the supervision of Robert B. Hobbs and Ruth A. Kronstadt, of the Bureau's leather section.

The tests also indicated that there was no significant difference in the wear of leather tanned from domestic and from frigorifico hides; that water-soluble material and grease are lost from soles in service, with the greatest loss being shown by water-soluble ash; that the so-called "rubber" and "leather" abrasive machines are of little use in predicting the relative wearing qualities of tannages; and that the water-soluble content, firmness, and degree of tannage are useful in estimating the wearing quality. The complete report on this work will be published as RP1626 in the Journal of Research for January.

HYDRAULIC BRAKE FAILURES

The attention of the Bureau has been called to the fact that an increasing number of hydraulic brakes on passenger cars and light trucks are becoming

hazardous through deterioration of the rubber-hose connections to the brake cylinders. These brake systems now use natural rubber pressure hose and hydraulic fluids that do not attack rubber. However, the hose connections are damaged by oil spilled on them from the outside and sometimes by oil that accidentally gets into the brake fluid. These cases of damage are increasing in number as cars grow older, as well as for other reasons.

When a damaged hose bursts, as it is likely to do when brakes are applied suddenly in an emergency, the car instantly loses all its braking ability at the time when brakes are most needed. Although such occasions are rare, they constitute a most critical and unforeseen hazard that leaves the driver almost helpless. The Bureau is making every effort to enlist the cooperation of all the agencies, public and private, that may contribute to the reduction of this hazard.

EFFECT OF TYPE OF BAR ON WIDTH OF CRACKS IN REINFORCED CONCRETE

Cracking of reinforced concrete subjected to tension is generally recognized as an unavoidable evil, and frequently, in order to minimize the width of tensile cracks in some structures, designing engineers use reinforcement steel in excess of the amount needed for strength. While this practice may achieve its purpose, it is possible to avoid wide cracks, with more economical use of steel, by securing better bond between concrete and reinforcement steel.

The tests recently completed by D. Watstein and N. A. Seese, Jr., were made to determine the effect of bonding efficiency of various types of deformed bars upon the widths of cracks in symmetrically reinforced specimens under axial tension. The relative bonding efficiencies of the bars were determined with test specimens of a new type by measuring the strain transmitted by the bar to the surrounding concrete. The bonding efficiency of the bars was found to be an index of the width of cracks observed in reinforced concrete specimens subjected to tension.

Eight types of commercial reinforcement bars were tested. It was found that the bar having the highest bond efficiency developed cracks the width of which was only 0.46 of that observed with the plain bar having the least bonding efficiency, when both bars carried a stress of 40,000 lb/in².

THERMAL SPALLING OF FIRE-CLAY BRICK

Fire-clay bricks are referred to as the "backbone of industry" because of their fundamental importance. In many types of furnace operations the firebrick linings are subject to rapid fluctuations in temperature, which cause stresses to develop in the brick, making them crack and spall. The service life of many furnace linings is directly related to the resistance of the brick to failure by thermal shock. In recent years the manufacturers have accomplished a great deal toward developing those properties in firebrick that are important so far as resistance to thermal shock is concerned. The testing of the bricks to determine their resistance to spalling has been accomplished either by the water dip test in which the individual heated specimens are plunged part way into cold water, or by rapidly cooling panels of heated brick by air alone or by a combination of air and water mist. The water dip test has been specified for many years in the Federal Specifications for firebrick. R. A. Heindl and W. L. Pendergast of the Bureau's refractories section recently completed an investigation of the spalling resistance of 50 brands of fire-clay brick by the standard test method of the American Society for Testing Materials. This method involves the conditioning of a panel of brick specimens by preheating to either 1,600° or 1,650° C (2,900° or 3,000° F), and after cooling, subjecting it to 12 cycles of 20 minutes' duration of alternate heating to 1,400° C (2,550° F) and then cooling by an air-water mist. Variations from the standard panel of brick in stretcher construction were made by laying brick as headers only, and in combinations of headers and stretchers. They represent the different types of construction used in furnace linings. Although there were exceptions, most firebrick showed greater losses in header construction than in stretcher, but in some cases the type of construction had little effect. It was also found that in general a relation exists between the pressure maintained in the furnace during the preheating of the brick and their resistance to spalling. The results of this investigation, which are given in full in the January Journal of Research (RP-1630), will be used as a basis for the technical requirements in a proposed revision of the current Federal Specification HH-B-671 for Fire-Clay Brick.

CORROSION OF UNDERGROUND PIPE LINES

Recognition of the facts that no iron or steel pipe now economically available can be expected to last long in some soils, and that protective coatings usually only delay corrosion, has emphasized the importance of other methods of protecting pipe. The most promising of these is an electrical method. If electrical connections are so made that current flows to the pipe line, the pipe will be protected from corrosion. This is done in many installations by supplying energy from a power plant. Considerable use is also made of zinc anodes electrically connected to the pipe lines. In 1941 the Bureau began a series of field tests to determine the conditions under which this method of protection may be effective. (Technical News Bulletin 296, December 1941.) Experimental combinations of zinc and steel were buried at 8 test sites, so arranged as to give different ratios of area of zinc to that of the steel. During the last month some of the specimens from a site near Shreveport, were returned to the Bureau. These show that a sample of steel not connected to the zinc lost from 40 to 50 times as much metal as similar samples connected to zinc anodes. These observations are, of course, preliminary, and further measurements will be necessary in order to determine the best methods of using the zinc. Moreover, it may be found possible to replace the zinc by aluminum or magnesium, thus providing a use for these metals of which large quantities are likely to be available. Arrangements are being made to bury test sets of these metals during the coming spring.

WILLING-TO-CERTIFY SOURCES OF SUPPLY OF PETROLEUM PRODUCTS

A revised list of willing-to-certify sources of supply of petroleum products (lubricants and liquid fuels) including asphalt; coke; road oil; tar; neat's foot, castor, and floor oil, conforming to Federal Specifications in the VV, P, Q, R, C, SS, and JJJ groups is now available for distribution. It is known as Supplement I to Part IB of Letter Circular LC256A, and was prepared under the direction of Sherman F. Booth; it is obtainable without charge from the producer contacts and certification section of the Bureau.

Firms that are included in the list have indicated their willingness to cer-

tify to purchasers, upon request, that commodities supplied on contracts based on the Federal Specifications under which the firms are listed, do actually comply with the requirements and tests therein set forth, and are so guaranteed. Purchasing by specification is thus facilitated, and the greatest obstacle to the general use of this method—the inability of most purchasers to learn of the sources of supply of commodities that comply with the specification requirements—is overcome. Under the plan, 15 "willing-to-certify" lists representing over 25,000 separate requests from industry, have been compiled. These listings are made up of more than 14,000 firms and relate to approximately 800 commodities covered by Federal Specifications.

A special notice is carried on all "willing-to-certify" lists calling attention to the 400 or more Emergency Alternate Federal Specifications that have been adopted as a war measure to conserve critical materials and that are mandatory in Government purchasing. Owing to the fact that under present conditions it is often impossible to buy products that conform to Federal Specifications, the Bureau is furnishing to all manufacturers on its "willing-to-certify" lists, copies of appropriate Emergency Alternate Specifications, and it is believed that these manufacturers are prepared to supply commodities that conform thereto as well as to Federal Specifications. Emergency Alternate Specifications are frequently changed and canceled without previous notice; information as to which specification he proposes to follow should always be obtained from the manufacturer before placing an order.

NEW MATHEMATICAL TABLES

Two additional publications in the series sponsored by the Bureau are now available.

The first of these, MT30, is entitled, A New Formula for Inverse Interpolation. It was prepared by Herbert E. Salzer and is devoted to the derivation of a formula for inverse interpolation in a table of equally spaced arguments. The resulting formula is more concise and convenient than others. It involves neither differences nor polynomial coefficients, other than small powers. In use it will be found much simpler and quicker than those given by Davis, Aitken, Steffensen, and Milne-Thompson. In a sense, it is the analog of the Lagrangian formula for direct interpolation without differences (that is, in terms of tabular entries only) if the

usual expression is rearranged in terms of powers of the argument p .

The second paper, MT31, Coefficients for Interpolation within a Square Grid in the Complex Plane, was prepared by Arnold M. Lowan and Herbert E. Salzer. This table gives the exact values of the real and imaginary parts of the 3-point and 4-point coefficients for both p and q , ranging from 0 to 1 at intervals of 0.1. The table will be found particularly useful when interpolation is to be carried out either for an isolated argument or for a large number of arguments that are irregularly scattered. Thus, for a 4-point interpolation for a single argument, the process, based on the new table, requires a total of 4 complex multiplications (equivalent to 16 ordinary multiplications) and 2 additions, whereas the method of interpolation in the real and imaginary parts, each considered as a function of x and y , by the use of real 4-point Lagrangian interpolation coefficients, requires 40 multiplications and 10 additions. The table, however, is not an efficient tool for carrying out an extensive and systematic process of subtabulation. For such a task, the latter method, involving the use of real interpolation coefficients, is almost twice as efficient from the standpoint of the total number of multiplications and additions.

The price of MT30 and MT31 is 25 cents each. Orders should be sent to the Information Section, National Bureau of Standards, Washington 25, D. C.

WILLIAM WEBER COBLENTZ RETIRES

William Weber Coblenz, chief of the Bureau's radiometry section and internationally known for his work in radiometry and related fields, was retired on December 1, 1944. Born in North Lima, Ohio, in 1873, and a graduate of Case School of Applied Science, he received his P.D. from Cornell in 1903 and joined the Bureau's staff as a laboratory assistant in 1905. He has devoted his life to research and is the author or co-author of 93 of the Bureau's publications; in addition, many reports of his work have appeared in this Bulletin and elsewhere. Among the early assignments of the radiometry section was the establishment of standards of radiation, in the form of carefully seasoned and calibrated electric lamps, that have been shipped to all parts of the world. In cooperation with the Lick

and Lowell observatories, Dr. Coblenz employed specially designed thermocouples and filters in combination with a sensitive galvanometer to determine the surface temperatures of stars and planets. Ultimately, he was able to determine temperatures at different locations on the surface of the planet Mars and to detect the daily and seasonal changes. He was awarded the Howard N. Potts gold medal by the Franklin Institute in 1910, the Jannsen medal of L'Institut de France in 1920, and the John Scott medal and premium in 1924 for these researches in infrared and stellar radiation.

The effect of radiation on health has been a matter of great interest to Dr. Coblenz. He studied the ultraviolet transmission of glass, fabrics, and other substances, and recently has been engaged in obtaining a continuous record of the intensity of ultraviolet radiation at Washington. He is a member of the Council on Physical Medicine of the American Medical Association. In 1934 the American Congress on Physical Therapy honored him by the award of its gold key—"the highest honor within the power of the Congress to bestow"—for meritorious service to medical science in the field of ultra violet radiation. The American Academy of Arts and Sciences presented him with the Rumford gold medal in 1937, in recognition of his work as a "pioneer in the technology and measurement of heat and light." In 1930 he was elected a fellow of the National Academy of Sciences. With Ralph Stair, he pioneered in advocating and using small unmanned balloons carrying automatic recording apparatus and radio-sending equipment to explore the ultraviolet in the stratosphere.

Dr. Coblenz hopes the Bureau will continue its research on the ultraviolet. In his own words "the one problem nearest my heart, and not completed, is the task of the International Committee on Measurement and Standardization of Ultraviolet for Use in Medicine, to establish a unit of dosage of biologically effective ultraviolet radiation; also to establish a primary standard meter for measuring ultraviolet solar and sky radiation for use in heliotherapy." The Bureau, he believes, has a unique opportunity to carry on this work.

Dr. Curtis J. Humphreys, who has been associated with Dr. Coblenz during the past year and who was formerly engaged in spectroscopic research at the Bureau, will become the new chief of the radiometry section.

NEW AND REVISED PUBLICATIONS ISSUED DURING DECEMBER 1944

Journal of Research¹

Journal of Research of the National Bureau of Standards, volume 33, number 4, October 1944 (RP1606 to RP1611, inclusive). Price 30 cents. Annual subscription, 12 issues, \$3.50.

Research Papers²

[Reprints from the October 1944 Journal of Research]

RP1606. Review of recent absolute determinations of the ohm and the ampere. Harvey L. Curtis. Price 10 cents.

RP1607. Heats of combustion of eight normal paraffin hydrocarbons in the liquid state. Edward J. Prosen and Frederick D. Rossini. Price 10 cents.

RP1610. Determination of tin in non-ferrous metals by distillation as bromide and precipitation with cupferon. William D. Mogerman. Price 5 cents.

RP1611. Machines and methods for testing cordage fibers. Herbert F. Schiefer. Price 10 cents.

Simplified Practice Recommendations²

R35-44. Steel lockers (Single, Double, and Multiple Tier). (Supersedes R35-28.) Price 5 cents.

Technical News Bulletin²

Technical News Bulletin 332, December 1944. Price 5 cents. Annual subscription, 50 cents.

MIMEOGRAPHED MATERIAL

Letter Circulars

[Letter Circulars are prepared to answer specific inquiries addressed to the National Bureau of Standards and are sent only on request to persons having a definite need for the information. The Bureau cannot undertake to supply lists or complete sets of Letter Circulars or send copies automatically as issued.]

LC771. List of published material relating to home building and maintenance. (Supersedes LC737.)

² Send orders for publications under this heading only to the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Subscription to Technical News Bulletin, 50 cents a year; Journal of Research, \$3.50 a year (to addresses in the United States and its possessions and to countries extending the franking privilege); other countries, 70 cents and \$4.50, respectively.

LC772. Weights and measures—a selected list of publications of the National Bureau of Standards. (Supersedes LC666.)

LC773. Spray painting. (Supersedes LC334.)

RECENT ARTICLES BY MEMBERS OF THE BUREAU'S STAFF PUBLISHED IN OUTSIDE JOURNALS²

Cathodic protection, theory and research. Kirk H. Logan. Gas (1709 W. Eighth St., Los Angeles 14, Calif.) 20, No. 11, 51 (November 1944).

Report on standard samples for spectrographic analysis. Wallace R. Brode and Bourdon F. Scribner. Am. Soc. for Testing Materials (260 S. Broad St., Philadelphia 2, Pa.) (October 1944).

Effect of developed width on strength of axially loaded curved sheet stringer panels. Albert E. McPherson, Kenneth L. Fienup, and George Zibritsky NACA Advance Restricted Report No. 4H08 (Natl. Adv. Com. for Aeronautics, Washington 25, D. C.) (November 1944) (Restricted).

Performance tests of wire strain gages I—calibration factors in tension. William R. Campbell NACA Technical Note No. 954 (Natl. Adv. Com. for Aeronautics, Washington 25, D. C.) (November 1944) (Restricted).

Some relations between stress, strain and temperature in a pure-gum vulcanizate of GR-S synthetic rubber. Frank L. Roth and Lawrence A. Wood. J. Applied Physics (350 Fifth Ave., New York 1, N. Y.) 15, 749 (November 1944).

Stress-temperature relations in a pure-gum vulcanizate of natural rubber. Lawrence A. Wood and Frank L. Roth. J. Applied Phys. 15, 781 (November 1944).

Fairing compositions for aircraft surfaces. Philip S. Turner, Jewel Doran, and Frank W. Reinhart. NACA Technical Note No. 958 (Natl. Adv. Com. for Aeronautics, Washington 25, D. C.) (November 1944) (Restricted).

Stress corrosion tests of bridge-cable wire. R. E. Pollard. Preprint No. 26 Joint Am. Soc. for Testing Materials—Am. Inst. of Mining and Metallurgical Engineers Symposium (Am. Soc. for Testing Materials, 260 S. Broad St., Philadelphia 2, Pa.) (November 1944).

² These publications are not obtainable from the Government, unless otherwise stated. Requests should be sent direct to the publishers.

